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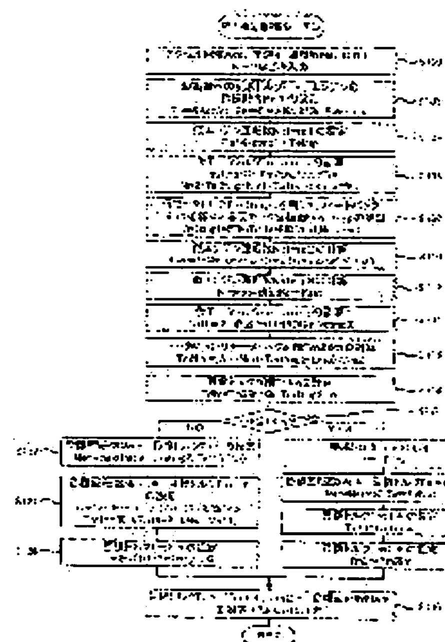
(54) POWER OUTPUT DEVICE, ITS CONTROL METHOD, AND AUTOMOBILE

(57)Abstract:
PROBLEM TO BE SOLVED: To comply with the request for a braking force placed at the time of releasing an accelerator while the charging limitation of an accumulator device is taken into consideration.
SOLUTION: The provisional engine speed Netmp1 is set as the rotating speed at a high efficiency operating point capable of emitting the target power Pe* required of an engine (S104), while the provisional engine speed Netmp2 is calculated as the rotating speed for meeting compatibly the requisite torque Tr* required of a drive shaft and the charge limitation Win of a battery (S106-S110), and that one of the two rotating speeds whichever is the greatest is set as the target rotating speed Ne* of the engine (S122), and thereupon the engine and/or two motors are controlled (S124 and S136). This allows managing well with a request for the braking force at the time of releasing the accelerator while the charging limitation of the battery is taken into consideration.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]
It is the power output unit which outputs power to a driving shaft,
With an internal combustion engine
A power power I/O means to transmit a part of power [at least] from said internal combustion engine to said driving shaft by I/O of power and power,
It is the motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
An operation point setting means to set up the operation point of said internal combustion engine for outputting the damping force this demanded based on the this demanded damping force and a charge limit of said accumulation-of-electricity means to said driving shaft when the damping force by accelerator close actuation is required of said driving shaft,
The control means which controls said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to said demanded damping force is outputted to said driving shaft, while said internal combustion engine is operated on the set-up this operation point
Preparation ****** output unit.
[Claim 2]
The relation to which the sum of the 1st driving force transmitted to said driving shaft based on the power with which said operation point setting means is outputted and inputted from said power power I/O means, and the 2nd driving force outputted to this driving shaft from said motor becomes equal to said demanded damping force, The relation to which the sum of the 1st power outputted and inputted by said power power I/O means and the 2nd power which are outputted and inputted by said motor becomes equal to a charge limit of said accumulation-of-electricity means, since -- the power output unit according to claim 1 which is a means to set up the rotational frequency calculated based on said 1st driving force called for as a target rotational frequency in said internal combustion engine's operation point.
[Claim 3]
Said operation point setting means As opposed to the relational expression of the target power which should be outputted and inputted from this power power I/O means at the time of carrying out feedback control of said power power I/O means using the this set-up target rotational frequency when said internal combustion engine's target rotational frequency is set up The power output unit according to claim 2 which is a means to set up said target rotational frequency obtained by inverse operation, using the power outputted and inputted from said power power I/O means calculated from said 1st driving force as said target power as a target rotational frequency in said internal combustion engine's operation point.
[Claim 4]
It is the power output unit which outputs power to a driving shaft,
With an internal combustion engine
A power power I/O means to transmit a part of power [at least] from said internal combustion

engine to said driving shaft by I/O of power and power,
It is the motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
A damping force limit setting means to set up the damping force limit as a limit to said demanded damping force based on the increment limit to the increment in the rotational frequency of said internal combustion engine by I/O of the power from said power power I/O means, and a charge limit of said accumulation-of-electricity means when the damping force by accelerator close actuation is required of said driving shaft,
The control means which controls said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to the damping force this demanded within the limits of the set-up this damping force limit is outputted to said driving shaft
Preparation ****** output unit.
[Claim 5]
Said damping force limit setting means The load limitation of said motor is set up based on the power outputted and inputted from the power power I/O means this computed while computing the power outputted and inputted with said power power I/O means by which said internal combustion engine's rotational frequency turns into a rotational frequency of the upper limit of said increment limit, and a charge limit of said accumulation-of-electricity means. The power output unit according to claim 4 which is a means to set up said damping force limit based on the power outputted and inputted with said set-up power power I/O means, and the load limitation of said motor.
[Claim 6]
Said damping force limit setting means is a power output unit according to claim 5 which is a means to set up said damping force limit based on the sum of the driving force transmitted to said driving shaft from this power power I/O means based on the power outputted and inputted with said computed power power I/O means, and the driving force outputted to said driving shaft from said motor based on the threshold value of said load limitation.
[Claim 7]
It is the power output unit which outputs power to a driving shaft,
With an internal combustion engine
A power power I/O means to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of power and power,
The motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
A 1st target power setting means to set up the target power which should be outputted from said internal combustion engine based on the demand driving force required of said driving shaft according to actuation by the operator,
A 2nd target power setting means to set up as target power which should output power lower than the target power which replaces with a setup of the target power by said 1st target power setting means, and is set up based on said demand driving force by this 1st target power setting means when an accelerator is operated by the operator towards closed actuation from open actuation from said internal combustion engine,
The control means which controls said power power I/O means and said motor so that said demand driving force is outputted to said driving shaft, while controlling said internal combustion engine by target power set up by said 1st or 2nd target power setting means
Preparation ****** output unit.
[Claim 8]
Said 2nd target power setting means is a power output unit according to claim 7 which is a means to set up as target power which should output power lower than this target power from said internal combustion engine based on the power which processed by annealing for an internal combustion engine's target power and this target power which are set up based on said demand driving force by said 1st target power setting means.

[Claim 9]
Said 2nd target power setting means is a power output unit according to claim 8 which is a means to set up as target power which should output the power which subtracted the power of difference with the power which processed by annealing for this target power and this target power for an internal combustion engine's target power set up based on said demand driving force by said 1st target power setting means from said internal combustion engine.
[Claim 10]
It is the power output unit which outputs power to a driving shaft,
With an internal combustion engine
A power power I/O means to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of power and power,
The motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
Said accumulation-of-electricity means, said power power I/O means, and auxiliary machinery that operates with consumption of the power produced in at least one of said motors,
The control means which controls said internal combustion engine, said power power I/O means, and said motor so that demand driving force is outputted to said driving shaft,
The auxiliary machinery control means which operates said auxiliary machinery compulsorily irrespective of the existence of actuation directions when it is predicted that the power which exceeds a charge limit of said accumulation-of-electricity means by control by said control means when the damping force by accelerator close actuation is required of said driving shaft is charged by this accumulation-of-electricity means
Preparation ****** output unit.
[Claim 11]
Said auxiliary machinery control means is a power output unit according to claim 10 which is a means to operate said auxiliary machinery so that the power exceeding a charge limit of said accumulation-of-electricity means of a part may be consumed.
[Claim 12]
It is a power output unit according to claim 10 or 11,
If said internal combustion engine, said power power I/O means, and said motor are controlled so that said demand driving force is outputted to said driving shaft, said control means When it is predicted that the power exceeding a charge limit of said accumulation-of-electricity means is charged by this accumulation-of-electricity means While said demand driving force is outputted to said driving shaft, it is a means to control said internal combustion engine, said power power I/O means, and said motor so that motoring of said internal combustion engine is carried out with said power power I/O means and power is consumed,
Said auxiliary machinery control means is a means to operate said auxiliary machinery compulsorily, when it is predicted that the power which exceeds a charge limit of said accumulation-of-electricity means also by motoring is charged by this accumulation-of-electricity means in said internal combustion engine by said power power I/O means.
Power output unit.
[Claim 13]
There is no claim 10 which is an air conditioner, and said auxiliary machinery is the power output unit of a publication 12 either.
[Claim 14]
There is no claim 1 which is a means equipped with a 3 shaft type power I/O means to output and input power on a residual shaft based on the power which connected with 3 of the output shaft, said driving shaft, and 3rd shaft of said internal combustion engine shafts, and was outputted and inputted on any 2 shafts of these three shafts, and the generator which output and input power on said 3rd shaft, and said power power I/O means is the power output unit of a publication 13 either.
[Claim 15]
the 1st rotator by which said power power I/O means was attached in said internal combustion

engine's output shaft, and the 2nd rotator attached in said driving shaft -- having -- the electromagnetism of this 1st rotator and this 2nd rotator -- claim 1 which is the pair-of-observations trochanter motor which outputs a part of power [at least] from this internal combustion engine to this driving shaft with I/O of the power by operation thru/or 13 -- either -- the power output unit of a publication.

[Claim 16]

Claim 1 thru/or the automobile is equipped with the power output unit of a publication 15 either, and it runs by connecting said driving shaft to an axle mechanically.

[Claim 17]

It is the control approach of an internal combustion engine, a power power I/O means to transmit a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, and the power output unit that equips this driving shaft with the motor which can output and input power, and this power power I/O means, and this motor and the accumulation-of-electricity means which can exchange power,

(a) When the damping force by accelerator close actuation is required of said driving shaft, set up the operation point of said internal combustion engine for outputting the damping force this demanded based on the this demanded damping force and a charge limit of said accumulation-of-electricity means to said driving shaft,

(b) While said internal combustion engine is operated on the set-up this operation point, control said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to said demanded damping force is outputted to said driving shaft.

The control approach of a power output unit.

[Claim 18]

It is the control approach of an internal combustion engine, a power power I/O means to transmit a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, and the power output unit that equips this driving shaft with the motor which can output and input power, and this power power I/O means, and this motor and the accumulation-of-electricity means which can exchange power,

(a) When the damping force by accelerator close actuation is required of said driving shaft, set up the damping force limit as a limit to said demanded damping force based on the increment limit to the increment in the rotational frequency of said internal combustion engine by I/O of the power from said power power I/O means, and a charge limit of said accumulation-of-electricity means,

(b) Control said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to the damping force this demanded within the limits of the set-up this damping force limit is outputted to said driving shaft.

The control approach of a power output unit.

[Claim 19]

It is the control approach of a power output unit equipped with an internal combustion engine, a power power I/O means to output a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, the motor that can output and input power to this driving shaft, and this power power I/O means, and this motor and the accumulation-of-electricity means which can exchange power,

(a) Set up the target power which should be outputted from said internal combustion engine based on the demand driving force required of said driving shaft according to actuation by the operator,

(b) When an accelerator is operated by the operator towards closed actuation from open actuation, set up as target power which should output power lower than the target power which replaces with a setup of the target power to step [said] (a) Depend, and is set up based on said demand driving force by this step (a) from said internal combustion engine,

(c) While controlling said internal combustion engine based on the target power set up by said step (a) or (b), control said power power I/O means and said motor so that the driving force corresponding to said demand driving force is outputted to said driving shaft.

The control approach of a power output unit.

[Claim 20]
An internal combustion engine and a power power I/O means to output a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, The motor which can output and input power to this driving shaft, and this motor and the accumulation-of-electricity means which can exchange power, [this power power I/O means, and] It is the control approach of a power output unit equipped with this accumulation-of-electricity means, this power power I/O means, and the auxiliary machinery that operates with consumption of the power produced in at least one of these motors,
(a) Control said internal combustion engine, said power power I/O means, and said motor so that demand driving force is outputted to said driving shaft,
(b) When it is predicted that the power which exceeds a charge limit of said accumulation-of-electricity means by control by said step (a) when the damping force by accelerator close actuation is required of said driving shaft is charged by this accumulation-of-electricity means, operate said auxiliary machinery compulsorily irrespective of the existence of actuation directions.
The control approach of a power output unit.
[Claim 21]
It is the power output unit in which an output of power is possible to a driving shaft,
With an internal combustion engine
A power power I/O means to have the 1st AC motor and to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of the power by this 1st AC motor, and power,
The 2nd AC motor which can output and input power to said driving shaft,
Said 1st AC motor and said 2nd AC motor, and the accumulation-of-electricity means which can exchange power,
An operation point setting means to set up the operation point of said internal combustion engine for outputting the demand driving force required of said driving shaft to this driving shaft,
Drive control of said internal combustion engine, said 1st AC motor, and said 2nd AC motor is carried out so that the driving force corresponding to said demand driving force may be outputted to said driving shaft, while said internal combustion engine is operated on said set-up operation point. By I/O of the power of the wattless component which this a part of dump power [at least] does not contribute to generating of driving force when the dump power exceeding a charge limit of said accumulation-of-electricity means occurs The drive control means which performs dump power consumption control which carries out drive control of said the 1st AC motor and said 2nd AC motor so that it may be consumed with said the 1st AC motor and/or said 2nd AC motor,
Preparation ****** output unit.
[Claim 22]
Said dump power consumption control is a power output unit according to claim 21 which is the control performed when the damping force by accelerator close actuation is required of said driving shaft.
[Claim 23]
It is a power output unit according to claim 21 or 22,
Said power power I/O means is equipped with a 3 shaft type power I/O means to output and input power on a residual shaft based on the power which connected with 3 of the output shaft, said driving shaft, and 3rd shaft of said internal combustion engine shafts, and was outputted and inputted on any 2 shafts of these three shafts,
Said 1st AC motor is a generator motor which can output and input power on said 3rd shaft.
Power output unit.
[Claim 24]
the 1st rotator by which said 1st AC motor was attached in said internal combustion engine's output shaft, and the 2nd rotator attached in said driving shaft -- having -- the electromagnetism of this 1st rotator and this 2nd rotator -- the power output unit according to claim 21 or 22 which is the pair-of-observations trochanter motor which outputs a part of power

[at least] from this internal combustion engine to this driving shaft with I/O of the power by operation

[Claim 25]

Claim 21 thru/or the automobile is equipped with the power output unit of a publication 24 either, and it runs by connecting said driving shaft with an axle.

[Claim 26]

Said dump power consumption control is an automobile according to claim 25 which is the control performed when the slip by slip is generated for the wheel connected to said axle.

[Claim 27]

It is the control approach of a power output unit equipped with an internal combustion engine, a power power I/O means to have the 1st AC motor and to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of the power by this 1st AC motor, and power, the 2nd AC motor that can output and input power to said driving shaft, said 1st AC motor and said 2nd AC motor, and the accumulation-of-electricity means which can exchange power,

(a) Set up the operation point of said internal combustion engine for outputting the demand driving force required of said driving shaft to this driving shaft,

(b) Carry out drive control of said internal combustion engine, said 1st AC motor, and said 2nd AC motor so that the driving force corresponding to said demand driving force may be outputted to said driving shaft, while said internal combustion engine is operated on said set-up operation point. By I/O of the power of the wattless component which this a part of dump power [at least] does not contribute to generating of driving force when the dump power exceeding a charge limit of said accumulation-of-electricity means occurs Drive control of said the 1st AC motor and said 2nd AC motor is carried out so that it may be consumed with said the 1st AC motor and/or said 2nd AC motor.

The control approach of a power output unit.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to a power output unit and its control approach list in an automobile at the power output unit which outputs power to a driving shaft in detail about an automobile, and its control approach list.
[Background of the Invention]
[0002]
The epicyclic gear device in which the ring wheel was connected to the driving shaft mechanically connected with the axle while the carrier was conventionally connected to the crankshaft of an engine and this engine as this kind of a power output unit, The thing equipped with the dc-battery which exchanges the 1st motor which outputs and inputs power to the sun gear of an epicyclic gear device, the 2nd motor which output and input power to a driving shaft, the 1st motor and the 2nd motor, and power is proposed (for example, patent reference 1 reference). In this power output unit, if the damping force by accelerator-off is demanded of a driving shaft by the operator, while charging regeneration energy at a dc-battery by carrying out regenerative control of the 2nd motor according to this demanded damping force, the damping force demanded by regenerative braking can be outputted to a driving shaft.
[Patent reference 1] JP,2000-197208,A (drawing 1)
[Description of the Invention]
[Problem(s) to be Solved by the Invention]
[0003]
However, since only the damping force only for the power which can receive a dc-battery can be outputted from the 2nd motor when the regeneration energy produced in case the damping force demanded using regenerative braking of the 2nd motor is made to act on a driving shaft in such a power output unit exceeds the power which can receive a dc-battery, drivability may be spoiled, without the ability outputting the demanded damping force to a driving shaft.
[0004]
The power output unit and its control approach of this invention set to one of the purposes to cope with the damping force demanded by accelerator close actuation, and to control aggravation of drivability, preventing overcharge of accumulation-of-electricity equipments, such as a dc-battery. Moreover, the automobile of this invention sets to one of the purposes to offer the automobile which copes with the damping force demanded by accelerator close actuation, and controls aggravation of drivability, preventing overcharge of accumulation-of-electricity equipments, such as a dc-battery.
[Means for Solving the Problem]
[0005]
In the power output unit and its control approach list of this invention, the automobile took the following means, in order to attain a part of above-mentioned purpose [at least].
[0006]
The 1st power output unit of this invention,

It is the power output unit which outputs power to a driving shaft,
With an internal combustion engine
A power power I/O means to transmit a part of power [at least] from said internal combustion engine to said driving shaft by I/O of power and power,
It is the motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
An operation point setting means to set up the operation point of said internal combustion engine for outputting the damping force this demanded based on the this demanded damping force and a charge limit of said accumulation-of-electricity means to said driving shaft when the damping force by accelerator close actuation is required of said driving shaft,
The control means which controls said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to said demanded damping force is outputted to said driving shaft, while said internal combustion engine is operated on the set-up this operation point
Let preparation ****** be a summary.
[0007]
The operation point of the internal combustion engine for outputting the damping force which the 1st power output unit of this this invention required based on the damping force required of the driving shaft by accelerator close actuation and a charge limit of an accumulation-of-electricity means to a driving shaft is set up. So that the damping force corresponding to the damping force demanded while the internal combustion engine was operated on the set-up operation point may be outputted to a driving shaft by I/O of power and power The motor which can output and input power is controlled to the power power I/O means and driving shaft which transmit a part of power [at least] from an internal combustion engine to a driving shaft. Therefore, since an internal combustion engine's operation point can be set up in consideration of the damping force and the charge limit of an accumulation-of-electricity means by accelerator close actuation, it can respond to the damping force required of a driving shaft, and a charge limit of an accumulation-of-electricity means. Consequently, aggravation of the drivability to the damping force demanded by accelerator close actuation can be controlled, considering a charge limit of an accumulation-of-electricity means.
[0008]
In the 1st power output unit of such this invention said operation point setting means The relation to which the sum of the 1st driving force transmitted to said driving shaft based on the power outputted and inputted from said power power I/O means and the 2nd driving force outputted to this driving shaft from said motor becomes equal to said demanded damping force, The relation to which the sum of the 1st power outputted and inputted by said power power I/O means and the 2nd power which are outputted and inputted by said motor becomes equal to a charge limit of said accumulation-of-electricity means, since -- it shall be a means to set up the rotational frequency calculated based on said 1st driving force called for as a target rotational frequency in said internal combustion engine's operation point If it carries out like this, the operation point of the internal combustion engine which is compatible in the damping force required of a driving shaft and a charge limit of an accumulation-of-electricity means can be set up.
[0009]
In the 1st power output unit of this invention of this mode said operation point setting means As opposed to the relational expression of the target power which should be outputted and inputted from this power power I/O means at the time of carrying out feedback control of said power power I/O means using the this set-up target rotational frequency when said internal combustion engine's target rotational frequency is set up It shall be a means to set up said target rotational frequency obtained by inverse operation, using the power outputted and inputted from said power power I/O means calculated from said 1st driving force as said target power as a target rotational frequency in said internal combustion engine's operation point.
[0010]

The 2nd power output unit of this invention,
It is the power output unit which outputs power to a driving shaft,
With an internal combustion engine
A power power I/O means to transmit a part of power [at least] from said internal combustion engine to said driving shaft by I/O of power and power,
It is the motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
A damping force limit setting means to set up the damping force limit as a limit to said demanded damping force based on the increment limit to the increment in the rotational frequency of said internal combustion engine by I/O of the power from said power power I/O means, and a charge limit of said accumulation-of-electricity means when the damping force by accelerator close actuation is required of said driving shaft,
The control means which controls said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to the damping force this demanded within the limits of the set-up this damping force limit is outputted to said driving shaft
Let preparation ****** be a summary.
[0011]
When the damping force by accelerator close actuation is required of a driving shaft in the 2nd power output unit of this this invention, The damping force limit as a limit to the damping force demanded based on the increment limit and the charge limit of an accumulation-of-electricity means to the increment in an internal combustion engine's rotational frequency by the output of the power of a power power I/O means is set up. So that the damping force corresponding to this damping force demanded within the limits of the set-up damping force limit may be outputted to a driving shaft by I/O of an internal combustion engine, power, and power The motor which can output and input power is controlled to the power power I/O means and driving shaft which transmit a part of power [at least] from an internal combustion engine to a driving shaft. Therefore, since the limit to the damping force demanded by accelerator close actuation in consideration of the increment limit of an internal combustion engine's rotational frequency and the charge limit of an accumulation-of-electricity means by I/O of the power from a power power I/O means can be set up, it can respond to the damping force required of the increment limit to the increment in an internal combustion engine's rotational frequency, and a driving shaft, and a charge limit of an accumulation-of-electricity means. Consequently, aggravation of the drivability to the damping force demanded by accelerator close actuation can be controlled, considering an internal combustion engine's rotational frequency within controllable limits at a charge limit of an accumulation-of-electricity means.
[0012]
In the 2nd power output unit of such this invention said damping force limit setting means The load limitation of said motor is set up based on the power outputted and inputted from the power power I/O means this computed while computing the power outputted and inputted with said power power I/O means by which said internal combustion engine's rotational frequency turns into a rotational frequency of the upper limit of said increment limit, and a charge limit of said accumulation-of-electricity means. It shall be a means to set up said damping force limit based on the power outputted and inputted with said set-up power power I/O means, and the load limitation of said motor.
[0013]
In the 2nd power output unit of this invention of this mode, said damping-force limit setting means shall be a means set up said damping-force limit based on the sum of the driving force transmitted to said driving shaft from this power power I/O means based on the power outputted and inputted with said computed power power I/O means, and the driving force outputted to said driving shaft from said motor based on the threshold value of said load limitation.
[0014]
The 3rd power output unit of this invention,
It is the power output unit which outputs power to a driving shaft,

With an internal combustion engine
A power power I/O means to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of power and power,
The motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
A 1st target power setting means to set up the target power which should be outputted from said internal combustion engine based on the demand driving force required of said driving shaft according to actuation by the operator,
A 2nd target power setting means to set up as target power which should output power lower than the target power which replaces with a setup of the target power by said 1st target power setting means, and is set up based on said demand driving force by this 1st target power setting means when an accelerator is operated by the operator towards closed actuation from open actuation from said internal combustion engine,
The control means which controls said power power I/O means and said motor so that said demand driving force is outputted to said driving shaft, while controlling said internal combustion engine by target power set up by said 1st or 2nd target power setting means
Let preparation ****** be a summary.
[0015]
In the 3rd power output unit of this this invention, when an accelerator is operated by the operator towards closed actuation from open actuation, power with the 2nd target power setting means lower than the target power set up by the 1st target power setting means as target power which should be outputted from an internal combustion engine based on the demand driving force according to actuation of an operator is set up. Therefore, demand driving force can be made to output to a driving shaft, considering a charge limit of an accumulation-of-electricity means, when it is operated towards the closed actuation from open actuation of an accelerator, since demand driving force was made to output to a driving shaft, stopping the power with which only a part with the low power outputted by the internal combustion engine charges the accumulation-of-electricity means from a power power I/O means or a motor. Consequently, an accelerator can control aggravation of the drivability to the damping force demanded by actuation to the direction [actuation / open] of closed actuation, considering a charge limit of an accumulation-of-electricity means.
[0016]
In the 3rd power output unit of such this invention, said 2nd target power setting means shall be a means to set up as target power which should output power lower than this target power from said internal combustion engine based on the power which processed by annealing for an internal combustion engine's target power and this target power which are set up based on said demand driving force by said 1st target power setting means.
[0017]
In the 3rd power output unit of this invention of this mode, said 2nd target power setting means shall be a means to set up as target power which should output the power which subtracted the power of difference with the power which processed by annealing for this target power and this target power for an internal combustion engine's target power set up based on said demand driving force by said 1st target power setting means from said internal combustion engine.
[0018]
The 4th power output unit of this invention,
It is the power output unit which outputs power to a driving shaft,
With an internal combustion engine
A power power I/O means to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of power and power,
The motor which can output and input power to said driving shaft,
Said power power I/O means, and said motor and the accumulation-of-electricity means which can exchange power,
Said accumulation-of-electricity means, said power power I/O means, and auxiliary machinery

that operates with consumption of the power produced in at least one of said motors,
The control means which controls said internal combustion engine, said power power I/O means, and said motor so that demand driving force is outputted to said driving shaft,
The auxiliary machinery control means which operates said auxiliary machinery compulsorily irrespective of the existence of actuation directions when it is predicted that the power which exceeds a charge limit of said accumulation-of-electricity means by control by said control means when the damping force by accelerator close actuation is required of said driving shaft is charged by this accumulation-of-electricity means
Let preparation ****** be a summary.
[0019]
In the 4th power output unit of this this invention, when the damping force by accelerator close actuation is required of a driving shaft So that this demanded damping force may be outputted to a driving shaft by I/O of an internal combustion engine, power, and power By controlling the motor which can output and input power to the power power I/O means and driving shaft which transmit a part of power [at least] from an internal combustion engine to a driving shaft When it is predicted that the power exceeding a charge limit of a power power I/O means and the accumulation-of-electricity means which can exchange a motor and power is charged The auxiliary machinery which operates with consumption of the power produced in at least one of an accumulation-of-electricity means, a power power I/O means, and motors is compulsorily operated irrespective of the existence of the actuation directions. Therefore, the damping force demanded by accelerator close actuation can be outputted to a driving shaft, considering a charge limit of an accumulation-of-electricity means. Consequently, aggravation of the drivability to the damping force demanded by accelerator close actuation can be controlled, considering a charge limit of an accumulation-of-electricity means.
[0020]
In the 4th power output unit of such this invention, said auxiliary machinery control means shall be a means to operate said auxiliary machinery so that the power exceeding a charge limit of said accumulation-of-electricity means of a part may be consumed.
[0021]
In the 4th power output unit of this invention moreover, said control means If said internal combustion engine, said power power I/O means, and said motor are controlled so that said demand driving force is outputted to said driving shaft When it is predicted that the power exceeding a charge limit of said accumulation-of-electricity means is charged by this accumulation-of-electricity means It is a means to control said internal combustion engine, said power power I/O means, and said motor so that motoring of said internal combustion engine is carried out with said power power I/O means and power is consumed, while said demand driving force is outputted to said driving shaft. Said auxiliary machinery control means shall be a means to operate said auxiliary machinery compulsorily, when it is predicted that the power which exceeds a charge limit of said accumulation-of-electricity means also by motoring is charged by this accumulation-of-electricity means in said internal combustion engine by said power power I/O means. When it is predicted that the power exceeding a charge limit of an accumulation-of-electricity means will be charged if it carries out like this, while being able to avoid overcharge by carrying out motoring of the internal combustion engine with a power power I/O means, when it is predicted that the power which exceeds a charge limit of an accumulation-of-electricity means also by this is charged, auxiliary machinery is operated compulsorily and overcharge can be avoided.
[0022]
Furthermore, in the 4th power output unit of this invention, said auxiliary machinery shall be an air conditioner.
[0023]
In the power output unit of either [this invention] the 1st thru/or the 4th either said power power I/O means A 3 shaft type power I/O means to output and input power on a residual shaft based on the power which connected with 3 of the output shaft, said driving shaft, and 3rd shaft of said internal combustion engine shafts, and was outputted and inputted on any 2 shafts of

these three shafts, Shall be the means which equips said 3rd shaft with the generator which outputs and inputs power, and said power power I/O means It is accompanied by I/O of the power by operation. the 1st rotator attached in said internal combustion engine's output shaft, and the 2nd rotator attached in said driving shaft -- having -- the electromagnetism of this 1st rotator and this 2nd rotator -- a part of power [at least] from this internal combustion engine It shall be the pair-of-observations trochanter motor outputted to this driving shaft.

[0024]

The automobile of this invention makes it a summary to have the power output unit of either [this invention of one of above-mentioned modes] the 1st thru/or the 4th either, and to run by connecting said driving shaft to an axle mechanically.

[0025]

According to the automobile of this this invention, since it has the power output unit of either [this invention of one of above-mentioned modes] the 1st thru/or the 4th either, the effectiveness with which such a power output unit is equipped, and the same effectiveness can be done so.

[0026]

The 5th power output unit of this invention,

It is the power output unit in which an output of power is possible to a driving shaft,

With an internal combustion engine

A power power I/O means to have the 1st AC motor and to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of the power by this 1st AC motor, and power,

The 2nd AC motor which can output and input power to said driving shaft,

Said 1st AC motor and said 2nd AC motor, and the accumulation-of-electricity means which can exchange power,

An operation point setting means to set up the operation point of said internal combustion engine for outputting the demand driving force required of said driving shaft to this driving shaft,

Drive control of said internal combustion engine, said 1st AC motor, and said 2nd AC motor is carried out so that the driving force corresponding to said demand driving force may be outputted to said driving shaft, while said internal combustion engine is operated on said set-up operation point. By I/O of the power of the wattless component which this a part of dump power [at least] does not contribute to generating of driving force when the dump power exceeding a charge limit of said accumulation-of-electricity means occurs The drive control means which performs dump power consumption control which carries out drive control of said the 1st AC motor and said 2nd AC motor so that it may be consumed with said the 1st AC motor and/or said 2nd AC motor,

Let preparation ****** be a summary.

[0027]

The operation point of the internal combustion engine for outputting the demand driving force required of a driving shaft to a driving shaft in the 5th power output unit of this this invention is set up. Drive control of an internal combustion engine, the 1st AC motor, and the 2nd AC motor is carried out so that the driving force corresponding to demand driving force may be outputted to a driving shaft, while an internal combustion engine is operated on this set-up operation point. By I/O of the power of the wattless component which a part of this dump power [at least] does not contribute to generating of driving force when the dump power exceeding a charge limit of an accumulation-of-electricity means occurs Dump power consumption control which carries out drive control of the 1st AC motor and 2nd AC motor so that it may be consumed with the 1st AC motor and 2nd AC motor is performed. Therefore, overcharge of an accumulation-of-electricity means and charge by superfluous power can be prevented, outputting the driving force corresponding to demand driving force to a driving shaft. Moreover, since a part of dump power [at least] is made to consume with the 1st AC motor and 2nd AC motor, it is not necessary to newly prepare the device which makes dump power consume.

[0028]

In the 5th power output unit of such this invention, said dump power consumption control shall

be control performed when the damping force by accelerator close actuation is required of said driving shaft.

[0029]

In the 5th power output unit of this invention moreover, said power power I/O means It has a 3 shaft type power I/O means to output and input power on a residual shaft based on the power which connected with 3 of the output shaft, said driving shaft, and 3rd shaft of said internal combustion engine shafts, and was outputted and inputted on any 2 shafts of these three shafts. Said 1st AC motor shall be a generator motor which can output and input power on said 3rd shaft, and In the 5th power output unit of this invention or said 1st AC motor It has the 1st rotator attached in said internal combustion engine's output shaft, and the 2nd rotator attached in said driving shaft. the electromagnetism of this 1st rotator and this 2nd rotator -- it shall be the pair-of-observations trochanter motor which outputs a part of power [at least] from this internal combustion engine to this driving shaft with I/O of the power by operation

[0030]

The 5th automobile of this invention,

It has the 5th power output unit of this invention of each mode mentioned above, and runs by connecting said driving shaft with an axle.

Let things be summaries.

[0031]

By 5th automobile of this this invention, since it has the 5th power output unit of this invention, the same effectiveness as the 5th power output unit of this invention can be done so.

[0032]

In the 5th automobile of such this invention, said dump power consumption control shall be control performed when the slip by slip is generated for the wheel connected to said axle.

[0033]

The control approach of the 1st power output unit of this invention,

It is the control approach of an internal combustion engine, a power power I/O means to transmit a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, and the power output unit that equips this driving shaft with the motor which can output and input power, and this power power I/O means, and this motor and the accumulation-of-electricity means which can exchange power,

(a) When the damping force by accelerator close actuation is required of said driving shaft, set up the operation point of said internal combustion engine for outputting the damping force this demanded based on the this demanded damping force and a charge limit of said accumulation-of-electricity means to said driving shaft,

(b) While said internal combustion engine is operated on the set-up this operation point, control said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to said demanded damping force is outputted to said driving shaft.

Let things be summaries.

[0034]

By the control approach of the 1st power output unit of this this invention The operation point of the internal combustion engine for outputting the damping force demanded based on the damping force required of the driving shaft by accelerator close actuation and a charge limit of an accumulation-of-electricity means to a driving shaft is set up. So that the damping force corresponding to the damping force demanded while the internal combustion engine was operated on the set-up operation point may be outputted to a driving shaft by I/O of power and power The motor which can output and input power is controlled to the power power I/O means and driving shaft which transmit a part of power [at least] from an internal combustion engine to a driving shaft. Therefore, since an internal combustion engine's operation point can be set up in consideration of the damping force and the charge limit of an accumulation-of-electricity means by accelerator close actuation, it can respond to the damping force required of a driving shaft, and a charge limit of an accumulation-of-electricity means. Consequently, aggravation of the drivability to the damping force demanded by accelerator close actuation can be controlled, considering a charge limit of an accumulation-of-electricity means.

[0035]
The control approach of the 2nd power output unit of this invention,
It is the control approach of an internal combustion engine, a power power I/O means to transmit a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, and the power output unit that equips this driving shaft with the motor which can output and input power, and this power power I/O means, and this motor and the accumulation-of-electricity means which can exchange power,
(a) When the damping force by accelerator close actuation is required of said driving shaft, set up the damping force limit as a limit to said demanded damping force based on the increment limit to the increment in the rotational frequency of said internal combustion engine by I/O of the power from said power power I/O means, and a charge limit of said accumulation-of-electricity means,
(b) Control said internal combustion engine, said power power I/O means, and said motor so that the damping force corresponding to the damping force this demanded within the limits of the set-up this damping force limit is outputted to said driving shaft.
Let things be summaries.
[0036]
By the control approach of the 2nd power output unit of this this invention When the damping force by accelerator close actuation is required of a driving shaft, the damping force limit as a limit to the damping force demanded based on the increment limit and the charge limit of an accumulation-of-electricity means to the increment in an internal combustion engine's rotational frequency by the output of the power of a power power I/O means is set up. So that the damping force corresponding to this damping force demanded within the limits of the set-up damping force limit may be outputted to a driving shaft by I/O of an internal combustion engine, power, and power The motor which can output and input power is controlled to the power power I/O means and driving shaft which transmit a part of power [at least] from an internal combustion engine to a driving shaft. Therefore, since the limit to the damping force demanded by accelerator close actuation in consideration of the increment limit of an internal combustion engine's rotational frequency and the charge limit of an accumulation-of-electricity means by I/O of the power from a power power I/O means can be set up, it can respond to the damping force required of the increment limit to the increment in an internal combustion engine's rotational frequency, and a driving shaft, and a charge limit of an accumulation-of-electricity means. Consequently, aggravation of the drivability to the damping force demanded by accelerator close actuation can be controlled, considering an internal combustion engine's rotational frequency within controllable limits at a charge limit of an accumulation-of-electricity means.
[0037]
The control approach of the 3rd power output unit of this invention,
It is the control approach of a power output unit equipped with an internal combustion engine, a power power I/O means to output a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, the motor that can output and input power to this driving shaft, and this power power I/O means, and this motor and the accumulation-of-electricity means which can exchange power,
(a) Set up the target power which should be outputted from said internal combustion engine based on the demand driving force required of said driving shaft according to actuation by the operator,
(b) When an accelerator is operated by the operator towards closed actuation from open actuation, set up as target power which should output power lower than the target power which replaces with a setup of the target power to step [said] (a) Depend, and is set up based on said demand driving force by this step (a) from said internal combustion engine,
(c) While controlling said internal combustion engine based on the target power set up by said step (a) or (b), control said power power I/O means and said motor so that the driving force corresponding to said demand driving force is outputted to said driving shaft.
Let things be summaries.

[0038]
By the control approach of the 3rd power output unit of this this invention, when an accelerator is operated by the operator towards closed actuation from open actuation, power with the 2nd target power setting means lower than the target power set up by the 1st target power setting means as target power which should be outputted from an internal combustion engine based on the demand driving force according to actuation of an operator is set up. Therefore, demand driving force can be made to output to a driving shaft, considering a charge limit of an accumulation-of-electricity means, when it is operated towards the closed actuation from open actuation of an accelerator, since demand driving force was made to output to a driving shaft, stopping the power with which only a part with the low power outputted by the internal combustion engine charges the accumulation-of-electricity means from a power power I/O means or a motor. Consequently, an accelerator can control aggravation of the drivability to the damping force demanded by actuation to the direction [actuation / open] of closed actuation, considering a charge limit of an accumulation-of-electricity means.
[0039]
The control approach of the 4th power output unit of this invention,
An internal combustion engine and a power power I/O means to output a part of power [at least] from this internal combustion engine to a driving shaft by I/O of power and power, The motor which can output and input power to this driving shaft, and this motor and the accumulation-of-electricity means which can exchange power, [this power power I/O means, and] It is the control approach of a power output unit equipped with this accumulation-of-electricity means, this power power I/O means, and the auxiliary machinery that operates with consumption of the power produced in at least one of these motors,
(a) Control said internal combustion engine, said power power I/O means, and said motor so that demand driving force is outputted to said driving shaft,
(b) When it is predicted that the power which exceeds a charge limit of said accumulation-of-electricity means by control by said step (a) when the damping force by accelerator close actuation is required of said driving shaft is charged by this accumulation-of-electricity means, operate said auxiliary machinery compulsorily irrespective of the existence of actuation directions.
Let things be summaries.
[0040]
By the control approach of the 4th power output unit of this this invention When the damping force by accelerator close actuation is required of a driving shaft So that this demanded damping force may be outputted to a driving shaft by I/O of an internal combustion engine, power, and power By controlling the motor which can output and input power to the power power I/O means and driving shaft which transmit a part of power [at least] from an internal combustion engine to a driving shaft When it is predicted that the power exceeding a charge limit of a power power I/O means and the accumulation-of-electricity means which can exchange a motor and power is charged The auxiliary machinery which operates with consumption of the power produced in at least one of an accumulation-of-electricity means, a power power I/O means, and motors is compulsorily operated irrespective of the existence of the actuation directions. Therefore, the damping force demanded by accelerator close actuation can be outputted to a driving shaft, considering a charge limit of an accumulation-of-electricity means. Consequently, aggravation of the drivability to the damping force demanded by accelerator close actuation can be controlled, considering a charge limit of an accumulation-of-electricity means.
[0041]
The control approach of the 5th power output unit of this invention,
It is the control approach of a power output unit equipped with an internal combustion engine, a power power I/O means to have the 1st AC motor and to output a part of power [at least] from said internal combustion engine to said driving shaft by I/O of the power by this 1st AC motor, and power, the 2nd AC motor that can output and input power to said driving shaft, said 1st AC motor and said 2nd AC motor, and the accumulation-of-electricity means which can exchange power,

(a) Set up the operation point of said internal combustion engine for outputting the demand driving force required of said driving shaft to this driving shaft,
(b) Carry out drive control of said internal combustion engine, said 1st AC motor, and said 2nd AC motor so that the driving force corresponding to said demand driving force may be outputted to said driving shaft, while said internal combustion engine is operated on said set-up operation point. By I/O of the power of the wattless component which this a part of dump power [at least] does not contribute to generating of driving force when the dump power exceeding a charge limit of said accumulation-of-electricity means occurs Drive control of said the 1st AC motor and said 2nd AC motor is carried out so that it may be consumed with said the 1st AC motor and/or said 2nd AC motor.
Let things be summaries.
[0042]
By the control approach of the 5th power output unit of this this invention The operation point of the internal combustion engine for outputting the demand driving force required of a driving shaft to a driving shaft is set up. Drive control of an internal combustion engine, the 1st AC motor, and the 2nd AC motor is carried out so that the driving force corresponding to demand driving force may be outputted to a driving shaft, while an internal combustion engine is operated on this set-up operation point. By I/O of the power of the wattless component which a part of this dump power [at least] does not contribute to generating of driving force when the dump power exceeding a charge limit of an accumulation-of-electricity means occurs Dump power consumption control which carries out drive control of the 1st AC motor and 2nd AC motor so that it may be consumed with the 1st AC motor and 2nd AC motor is performed. Therefore, overcharge of an accumulation-of-electricity means and charge by superfluous power can be prevented, outputting the driving force corresponding to demand driving force to a driving shaft. Moreover, since a part of dump power [at least] is made to consume with the 1st AC motor and 2nd AC motor, it is not necessary to newly prepare the device which makes dump power consume.
[Best Mode of Carrying Out the Invention]
[0043]
Next, the best gestalt for carrying out this invention is explained using an example.
[Example 1]
[0044]
Drawing 1 is the block diagram showing the outline of the configuration of a hybrid car 20 in which the power output unit as 1 operation gestalt of this invention was carried. The hybrid car 20 of an example so that it may illustrate An engine 22, The power distribution integrated device 30 of 3 shaft type connected to the crankshaft 26 as an output shaft of an engine 22 through the damper 28, The reduction gear 35 attached in ring wheel shaft 32a as a driving shaft connected to the motor MG 1 which was connected to the power distribution integrated device 30, and which can be generated, and the power distribution integrated device 30, It has the motor MG 2 connected to this reduction gear 35, and the electronic control unit 70 for hybrids which controls the whole power output unit.
[0045]
An engine 22 is an internal combustion engine which outputs power with the fuel of hydrocarbon systems, such as a gasoline or gas oil, and has received operation controls, such as fuel-injection control, and ignition control, inhalation air-adjust control, from the various sensors which detect the operational status of an engine 22 with the electronic control unit 24 for engines (henceforth Engine ECU) which inputs a signal. The engine ECU 24 is communicating with the electronic control unit 70 for hybrids, and it outputs the data about the operational status of an engine 22 to the electronic control unit 70 for hybrids if needed while it carries out the operation control of the engine 22 with the control signal from the electronic control unit 70 for hybrids.
[0046]
The power distribution integrated device 30 is equipped with an external-tooth gearing's sun gear 31, this sun gear 31 and the ring wheel 32 of the internal gear arranged on a concentric

circle, two or more pinion gears 33 that gear to a ring wheel 32 while gearing to a sun gear 31, and the carrier 34 which holds two or more pinion gears 33 free [rotation and revolution], and is constituted as an epicyclic gear device in which a differential operation is performed by using a sun gear 31, a ring wheel 32, and a carrier 34 as a rotation element. On a carrier 34, the power distribution integrated device 30 the crankshaft 26 of an engine 22 The reduction gear 35 is connected with the ring wheel 32 for the motor MG 1 through ring wheel shaft 32a at the sun gear 31, respectively. The power from the engine 22 inputted from a carrier 34 when a motor MG 1 functions as a generator is distributed to a sun gear 31 and ring wheel 32 side according to the gear ratio. When a motor MG 1 functions as a motor, the power from the motor MG 1 inputted from the power and the sun gear 31 from the engine 22 inputted from a carrier 34 is unified, and it outputs to a ring wheel 32 side. Finally the power outputted to the ring wheel 32 is outputted to the driving wheels 63a and 63b of a car through the gear device 60 and a differential gear 62 from ring wheel shaft 32a.
[0047]
A motor MG 1 and a motor MG 2 are constituted as a synchronous generator motor (for example, synchronous generator motor of PM mold equipped with the stator around which Rota where the permanent magnet was stuck on the outside surface, and a three phase coil were wound) which can function also as a generator while they function as a motor, and they perform an exchange of a dc-battery 50 and power through inverters 41 and 42. Power Rhine 54 which connects inverters 41 and 42 and a dc-battery 50 is constituted as the positive-electrode bus-bar which each inverters 41 and 42 share, and a negative-electrode bus-bar; and can consume now the power generated with either of the motors MG1 and MG2 by other motors. Therefore, the charge and discharge of the dc-battery 50 will be carried out by the power produced from either of the motors MG1 and MG2, or insufficient power. In addition, the charge and discharge of the thing which balances power income and outgo by motors MG1 and MG2, then the dc-battery 50 are not carried out. Drive control of the motors MG1 and MG2 is carried out by each with the electronic control unit 40 for motors (henceforth Motor ECU). The phase current impressed to the motors MG1 and MG2 detected by a signal required in order to carry out drive control of the motors MG1 and MG2, for example, the signal from the rotation location detection sensors 43 and 44 which detect the rotation location of the rotator of motors MG1 and MG2, and the current sensor which is not illustrated is inputted into the motor ECU 40, and the switching control signal to inverters 41 and 42 is outputted from the motor ECU 40. The motor ECU 40 is communicating with the electronic control unit 70 for hybrids, and it outputs the data about the operational status of motors MG1 and MG2 to the electronic control unit 70 for hybrids if needed while it carries out drive control of the motors MG1 and MG2 with the control signal from the electronic control unit 70 for hybrids.
[0048]
The dc-battery 50 is managed with the electronic control unit 52 for dc-batteries (henceforth Dc-battery ECU). A signal required to manage a dc-battery 50 to a dc-battery ECU 52, For example The electrical potential difference between terminals from the voltage sensor which was installed between the terminals of a dc-battery 50 and which is not illustrated, The cell temperature Tb from the temperature sensor 51 attached in the charge and discharge current from the current sensor which was attached in power Rhine 54 connected to the output terminal of a dc-battery 50, and which is not illustrated and the dc-battery 50 etc. is inputted. The data about the condition of a dc-battery 50 are outputted to the electronic control unit 70 for hybrids by communication link if needed. In addition, with the dc-battery ECU 52, in order to manage a dc-battery 50, remaining capacity (SOC) is also calculated based on the addition value of the charge and discharge current detected by the current sensor.
[0049]
In addition, the air conditioner (henceforth an air-conditioner) 90 which air-conditions space in the crew cabin of a hybrid car 20 is connected to power Rhine 54 where a dc-battery 50 and motors MG1 and MG2 are connected through the converter 94. This air-conditioner 90 operates using the accumulation-of-electricity power of a dc-battery 50 and the generated output of motors MG1 and MG2 which were supplied through the converter 94.

[0050]
The electronic control unit 70 for hybrids is constituted as a microprocessor centering on CPU72, and is equipped with ROM74 which memorizes the processing program other than CPU72, RAM76 which memorizes data temporarily, and the input/output port and the communication link port which is not illustrated. In the electronic control unit 70 for hybrids The accelerator opening Acc from the accelerator pedal position sensor 84 which detects the shift position SP from the shift position sensor 82 which detects the actuated valve position of the ignition signal from an ignition switch 80, and a shift lever 81, and the amount of treading in of an accelerator pedal 83, An active signal etc. minds input port from the airconditioning switch 92 for directing actuation of the vehicle speed V from the brake-pedal position BP and speed sensor 88 from the brake-pedal position sensor 86 which detects the amount of treading in of a brake pedal 85, and an air-conditioner 90. It is inputted. Moreover, it connects with the engine ECU 24, the motor ECU 40, and the dc-battery ECU 52 through the communication link port, and the electronic control unit 70 for hybrids is performing the exchange of an engine ECU 24, a motor ECU 40, a dc-battery ECU 52, and various control signals and data, as mentioned above.
[0051]
In this way, the hybrid car 20 of the constituted example calculates the demand torque which should be outputted to ring wheel shaft 32a as a driving shaft based on the accelerator opening Acc and the vehicle speed V corresponding to the amount of treading in of an accelerator pedal 83 by the operator, and the operation control of an engine 22, a motor MG 1, and the motor MG 2 is carried out so that the demand power corresponding to this demand torque may be outputted to ring wheel shaft 32a. As an operation control of an engine 22, a motor MG 1, and a motor MG 2 While carrying out the operation control of the engine 22 so that the power corresponding to demand power may be outputted from an engine 22 All the power outputted from an engine 22 by the power distribution integrated device 30, the motor MG 1, and the motor MG 2 So that torque conversion may be carried out and it may be outputted to ring wheel shaft 32a While carrying out the operation control of the engine 22 so that the power corresponding to the sum of the torque conversion operation mode and demand power which carry out drive control of a motor MG 1 and the motor MG 2, and power required for the charge and discharge of a dc-battery 50 may be outputted from an engine 22 So that demand power may be outputted to ring wheel shaft 32a with torque conversion according [all of the power outputted from an engine 22 with the charge and discharge of a dc-battery 50 or its part] to the power distribution integrated device 30, a motor MG 1, and a motor MG 2 There are charge-and-discharge operation mode which carries out drive control of a motor MG 1 and the motor MG 2, motor operation mode which carries out an operation control so that the power which suspends operation of an engine 22 and balances demand power from a motor MG 2 may be outputted to ring wheel shaft 32a.
[0052]
Next, actuation when actuation of the hybrid car 20 of the example constituted in this way, especially an operator do off actuation of the accelerator pedal 83 is explained. Drawing 2 is a flow chart which shows an example of the 1st operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car 20 of an example. This routine is repeatedly performed for every (every [for example,] 8msec) predetermined time from from, when an operator does OFF actuation of the accelerator pedal 83. In addition, the judgment of OFF actuation of an accelerator pedal 83 can be performed based on the accelerator opening Acc detected by the accelerator pedal position sensor 84.
[0053]
If the 1st operation control routine is performed, CPU72 of the electronic control unit 70 for hybrids will first perform processing which inputs data required for control, such as 1 and Nm2, several Nm rotation of the vehicle speed V from the accelerator opening Acc and the speed sensor 88 from an accelerator pedal 83, the rotational frequency Ne of the crankshaft 26 of an engine 22, a motor MG 1, and a motor MG 2 (step S100). Here, 1 and Nm2 shall input by communication link what was calculated based on the rotation location of the rotator of the motors MG1 and MG2 detected by the rotation location detection sensors 43 and 44 from a

motor ECU 40 several Nm rotation of motors MG1 and MG2. Moreover, the rotational frequency Ne of an engine 22 shall input what was calculated based on the rotational frequency Nr of ring wheel shaft 32a which breaks 2 by the gear ratio Gr (rotational frequency of the rotational frequency / ring wheel shaft 32a of a motor MG 2) of a reduction gear 35 motor's MG's 1 several Nm rotation 1 and several Nm rotation of a motor MG 2, and is obtained, and gear ratio rho (a sun gear number of teeth / ring wheel number of teeth) of the power distribution integrated device 30. Of course, a rotational frequency sensor is attached in the crankshaft 26 of an engine 22, and it is not cared about as a thing using that by which direct detection was carried out.
[0054]
Then, while setting up demand torque Tr* required of ring wheel shaft 32a as a driving shaft based on the accelerator opening Acc and the vehicle speed V, target power Pe* which an engine 22 should output is set up (step S102). In the example, it is memorized to ROM74, using a setup of demand torque Tr* as the map for demand set torques beforehand in quest of the relation between the accelerator opening Acc, and the vehicle speed V and demand torque Tr*, and if the accelerator opening Acc and the vehicle speed V are given, it shall draw and set up demand torque Tr* which corresponds from the map for demand set torques. An example of the map for demand set torques is shown in drawing 3 . A setup of target power Pe* of an engine 22 shall set up the thing adding charge-and-discharge amount-required Pb* of the dc-battery 50 set as what multiplied set-up demand torque Tr* by the engine speed Nr of ring wheel shaft 32a according to the remaining capacity (SOC) of a dc-battery 50, and a loss as target power Pe* of an engine 22 in the example. In addition, it can ask for the rotational frequency Nr of ring wheel shaft 32a by asking by multiplying the vehicle speed V by the conversion factor k, or breaking 2 by the gear ratio Gr of a reduction gear 35 several Nm rotation of a motor MG 2.
[0055]
A setup of target power Pe* sets up the engine speed in the operation point which can operate an engine 22 efficiently among the operation points (torque, an engine speed, and point that becomes settled) of the engine 22 in which an output of this target power Pe* is possible as a temporary engine speed Netmp1 (step S104).
[0056]
next, a motor MG 1 is temporary from a degree type (1) and a formula (2) using the charge limit Win (the direction of charge is made negative) of demand torque Tr* of ring wheel shaft 32a as a driving shaft, or a dc-battery 50 set up at step S102 -- motor torque Tm1tmp1 is calculated (step S106). It is the relation what added the loss to total of the power by which a formula (2) is outputted and inputted by the motor MG 1 and the motor MG 2 is a formula (1) is relation to which total of the torque outputted to ring wheel shaft 32a as a driving shaft by the motor MG 1 and the motor MG 2 becomes equal to demand torque Tr*, and equal to the charge limit Win of a dc-battery 50 here unrelated. In addition, the charge limit Win of a dc-battery 50 can be calculated from the cell temperature Tb, remaining capacity (SOC), etc. of a dc-battery 50. The collinear Fig. for explaining dynamically the rotation element of the power distribution integrated device 30 to drawing 4 is shown. Two thick wire arrow heads, in drawing and R top, show the torque which torque Te* outputted from an engine 22 is delivered to ring wheel shaft 32a through the power distribution integrated device 30 while operating the engine 22 steadily on the operation point of target torque Te* and target engine-speed Ne*, and the torque to which the torque outputted from a motor MG 2 acts on a ring wheel 32 through a reduction gear 35. Therefore, it turns out that the left part of a formula (1) serves as torque of the sum with the torque transmitted to ring wheel shaft 32a through the power distribution integrated device 30 from an engine 22 when Tm1tmp1 is outputted from the torque transmitted through a reduction gear 35 when torque Tm2tmp is outputted from a motor MG 2, and a motor MG 1.
[0057]
Tm2tmp-Gr-Tm1tmp1/rho=Tr* (1)
Nm2, Tm2 tmp+Nm1, and Tm1 tmp+Loss=Win (2)
[0058]
and When target several Nm rotation 1* is set up The relational expression showing in the degree type (3) for searching for the torque (target torque Tm1*) which should output a motor

MG 1 based on the deflection of 1 from the motor MG 1 in the feedback control for rotating a motor MG 1 by target several Nm rotation 1* target several Nm rotation 1* and several Nm current rotation temporary [replace with target torque Tm1* and] -- counting backward using motor torque Tm1tmp1 -- several temporary motor rotations -- Nm1tmp is calculated (step S108). temporary -- motor torque Tm1tmp1 and several temporary motor rotations -- the relational expression using Nm1tmp is shown as a formula (4). Here, the function PID in a formula (3) and a formula (4) is constituted by the proportional, integral term, or differential term in feedback control. Moreover, "last Tm1*" is the target torque of the motor MG 1 set up by step S124 later mentioned by the last 1st operation control routine, or S132.

[0059]

Tm1*= last time Tm1*+PID (Nm1, Nm1*) (3)

Tm1tmp1= last time Tm1*+PID (Nm1, Nm1tmp) (4)

[0060]

in this way, several temporary motor rotations -- several temporary motor rotations calculated when Nm1tmp was calculated -- the temporary engine speed Netmp2 is calculated by the degree type (5) using gear ratio rho of Nm1tmp, the rotational frequency Nr (Nm2/Gr) of current ring wheel shaft 32a, and the power distribution integrated device 30 (step S110). Processing of such steps S106-S110 can be called processing which calculates the temporary engine speed Netmp2 as an engine speed of the engine 22 which reconciles demand torque Tr* and the charge limit Win of a dc-battery 50 that it should act on ring wheel shaft 32a as a driving shaft.

[0061]

Netmp2=Nm1tmp-rho/(1+rho) +(Nm2/Gr)/(1+rho) (5)

[0062]

Next The rotational frequency which applied the increment rotational frequency Nset set as target rotational frequency Ne* (last Ne*) of the engine 22 set up by step S122 which the last 1st operation control routine mentions later, or S130 as an increment limit is calculated as a temporary engine speed Netmp3 (step S112). By the feedback control for rotating an engine 22 by the temporary engine speed Netmp3 based on the deflection of the calculated temporary engine speed Netmp3 and the engine speed Ne of the current engine 22 it should output from a motor MG 1 -- temporary -- motor torque Tm1tmp2 is calculated using a degree type (6) (step S114).

[0063]

Tm1tmp2= last time Tm1*+PID (Ne, Netmp3) (6)

[0064]

and By step S114 from the charge limit Win of a dc-battery 50 Divide by 2 what subtracted the product (power) and loss of 1 motor torque Tm1tmp2 and several Nm current rotation several Nm current rotation of a motor MG 2, and it outputs from a motor MG 2. the calculated motor MG 1 is temporary -- Motor torque limitation Tm2lim as torque with sufficient ** is calculated (step S116). A degree type (7) is used based on motor torque Tm1tmp2 and gear ratio rho of the power distribution integrated device 30. it calculated at this motor torque limitation Tm2lim and step S114 that were calculated -- temporary -- as a driving shaft Demand torque limitation Trlim as torque which may be outputted to ** ring wheel shaft 32a is calculated (step S118). Processing of such steps S112-S118 can be called processing which calculates the limitation of the damping torque which can be outputted to ring wheel shaft 32a within the limits of the charge limit Win of a dc-battery 50 when raising the engine speed of an engine 22 with the output of the torque from a motor MG 1 within limits which an engine 22 blows up and can prevent admiration.

[0065]

Trlim=Tm2 lim-Gr-Trm1tmp2/rho (7)

[0066]

In this way, if demand torque limitation Trlim is calculated, since both whether it being below demand torque limitation Trlim by which demand torque Tr* of ring wheel shaft 32a as a driving shaft set up at step S102 was calculated, and demand torque Tr*, i.e., demand torque limitation Trlim, are negative values, the absolute value of demand torque Tr* will judge whether it is more

than the absolute value of demand torque limitation Trlim (step S120). If judged with demand torque Tr* not being below demand torque limitation Trlim While setting up the engine speed of the larger one of the temporary engine speed Netmp1 calculated at step S104, and the temporary engine speeds Netmp2 calculated at step S110 as target engine-speed Ne* of an engine 22 It breaks by target engine-speed Ne* which set up target power Pe* of an engine 22, and sets up as target torque Te* of an engine 22 (step S122). Thereby, the rotational frequency of the engine 22 which reconciles demand torque Tr* and the charge limit Win of a dc-battery 50 can be set up as target rotational frequency Ne*. and While setting up target several Nm rotation 1* of a motor MG 1 by the degree type (8) using target rotational frequency Ne* of an engine 22 and the rotational frequency Nr (Nm2/Gr) of ring wheel shaft 32a which were set up, and gear ratio rho of the power distribution integrated device 30 Target torque Tm1* of a motor MG 1 is set up by the above-mentioned formula (3) using 1 target several Nm rotation 1* of the set-up motor MG 1, and several Nm current rotation (step S124). Target torque Tm2* of a motor MG 2 is set up by the degree type (9) using demand torque Tr*, target torque Tm1* of the set-up motor MG 1, gear ratio rho of the power distribution integrated device 30, and the gear ratio Gr of a reduction gear 35 (step S126).

[0067]

Nm1*=Ne*-(1+rho)/rho+(Nm2/Gr)/rho (8)

Tm2*= (Tr*+Tm1*/rho)/Gr (9)

[0068]

On the other hand, if judged with demand torque Tr* being below demand torque limitation Trlim by processing of step S120 It is judged that it cannot make demand torque Tr* act on ring wheel shaft 32a according to an increment limit of the engine speed of an engine 22, and the charge limit Win of a dc-battery 50. Demand torque Tr* set up at step S102 is corrected to demand torque limitation Trlim (step S128). While setting up the temporary engine speed Netmp3 calculated at step S112 as target engine-speed Ne* of an engine 22, it breaks by target engine-speed Ne* which set up target power Pe* of an engine 22, and target torque Te* is set up (step S130). and it was calculated at step S114 -- temporary -- while setting up motor torque Tm1tmp2 as target torque Tm1* of a motor MG 1 (step S132), motor torque limitation Tm2lim calculated at step S116 is set up as target torque Tm2* of a motor MG 2 (step S134).

[0069]

In this way, if target rotational frequency Ne* of an engine 22 and target torque Te*, target torque Tm1* of a motor MG 1, and target torque Tm2* of a motor MG 2 are set up by either processing of steps S122-S126 and steps S130-S134 About target engine-speed Ne* of an engine 22, and target torque Te*, in an engine ECU 24 Processing respectively outputted to a motor ECU 40 about target torque Tm1* of a motor MG 1 and target torque Tm2* of a motor MG 2 is performed (step S136), and this routine is ended. Thereby, the engine ECU 24 which received target engine-speed Ne* and target torque Te* controls fuel-injection control, ignition control, etc. in an engine 22 so that an engine 22 is operated by target engine-speed Ne* and target torque Te*. Moreover, the motor ECU 40 which received target rotation severalNm1* and target torque Tm1*, and target torque Tm2* performs switching control of the switching element of inverters 41 and 42 so that a motor MG 2 may be operated by target torque Tm2*, while a motor MG 1 is operated by target torque Tm1*.

[0070]

The engine speed in the operation point (efficient operation point) of the engine 22 in which an output of target power Pe* set up based on demand torque Tr* to ring wheel shaft 32a is possible according to the hybrid car 20 of an example explained above (temporary engine speed Netmp1), Since the engine speed of the larger one is set up as target engine-speed Ne* of an engine 22 among the engine speeds (temporary engine speed Netmp2) which reconcile demand torque Tr* of ring wheel shaft 32a, and the charge limit Win of a dc-battery 50 and an engine 22 and motors MG1 and MG2 are controlled It can respond to demand torque Tr*, preventing overcharge of a dc-battery 50. Consequently, aggravation of drivability can be controlled, taking into consideration the charge limit Win of a dc-battery 50.

[0071]

Moreover, according to the hybrid car 20 of an example Since demand torque Tr* is restricted within the limits of demand torque limitation Trlim in consideration of the increment limit and the charge limit Win of a dc-battery 50 to the increment in the engine speed of the engine 22 according to the output torque from a motor MG 1 and an engine 22 and motors MG1 and MG2 are controlled It can respond to demand torque Tr*, the engine speed of an engine 22 blowing up and preventing admiration and overcharge of a dc-battery 50.
[0072]
In the hybrid car 20 of an example, although a limit shall be added to demand torque Tr* in consideration of the increment limit and the charge limit Win of a dc-battery 50 to the increment in the engine speed of an engine 22, it does not interfere as what does not take into consideration an increment limit of the engine speed of an engine 22. What is necessary is just not to perform processing of steps S112-S120 of the 1st operation control routine of drawing 2 , and steps S128-S134 at this time.
[0073]
Although the engine speed of the engine 22 which reconciles demand torque Tr* and the charge limit Win of a dc-battery 50 shall be taken into consideration in the hybrid car 20 of an example in case target engine-speed Ne* of an engine 22 is set up, it does not interfere as what does not take into consideration the engine speed of the engine 22 which reconciles this demand torque Tr* and the charge limit Win. What is necessary is just to set up the temporary engine speed Netmp1 which should perform processing of steps S106-S110 of the 1st operation control routine of drawing 2 , and was calculated at step S104 as target engine-speed Ne* in step S122 at this time.
[0074]
temporary to the relational expression of the feedback control according to PID control at the process which calculates the temporary engine speed Netmp2 in the hybrid car 20 of an example -- counting backward using motor torque Tm1tmp1 -- several temporary motor rotations -- although Nm1tmp shall be calculated, feedback control is good also as feedback control by the PI control which is not limited to PID control and does not have a differential term, and good also as feedback control by the proportional control which does not have an integral term further.
[Example 2]
[0075]
Next, the hybrid car of the 2nd example is explained. The hybrid car of the 2nd example is equipped with the same configuration as the hybrid car 20 of an example except for the point that the processings performed with the electronic control unit 70 for hybrids differ. Therefore, the sign same about the same configuration of the hybrid car 20 of an example is attached among the hybrid cars of the 2nd example, and since the detailed explanation overlaps, it is omitted. Drawing 5 is a flow chart which shows an example of the 2nd operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car of the 2nd example. This routine is repeatedly performed for every (every [for example,] 8msec) predetermined time from from, when the accelerator pedal 83 which the operator had broken in is returned. In addition, the judgment of whether the accelerator pedal 83 which the operator had broken in was returned can be performed based on the accelerator opening Acc of last time and this time.
[0076]
When the 2nd operation control routine is performed, CPU72 of the electronic control unit 70 for hybrids first, like processing of steps S100 and S102 of the 1st operation control routine of drawing 2 1, Nm2, etc. are inputted the accelerator opening Acc, the vehicle speed V, the rotational frequency Ne of an engine 22, and several Nm rotation of motors MG1 and MG2 (step S200). While setting up demand torque Tr* of ring wheel shaft 32a as a driving shaft using the map illustrated to above-mentioned drawing 3 with the inputted accelerator opening Acc and the vehicle speed V It sets up as temporary target power Petmp1 which should output what added charge-and-discharge amount-required Pb* of a dc-battery 50, and a loss to what multiplied set-up demand torque Tr* by the engine speed Nr (Nm2/Gr) of ring wheel shaft 32a from an engine 22 (step S202).
[0077]

Then, it anneals for the temporary target power Petmp1 of the set-up engine 22, and processed and anneals, and the target power Petmp2 is calculated by the degree type (10) (step S204). Here, among a formula (10), "last Petmp2" was calculated by processing of the last 2nd operation control routine, is annealed, and is target power. Moreover, "K" is a constant, and it is set up in the range of a value 1 - a value 0 so that the target power of an engine 22 may be changed smoothly.
[0078]
Petmp2= last time Petmp2+(Petmp1-last time Petmp2) -K (10)
[0079]
Next, while annealing with this temporary target power Petmp1 and setting up deflection with the target power Petmp2 as an amount Peus of undershooting (step S206), it guards with a value 0 so that the set-up amount Peus of undershooting may hold a negative value (step S208), and what applied the negative amount Peus of undershooting to the temporary target power Petmp1 of an engine 22 is set up as target power Pe* of an engine 22 (step S210). Here, the amount Peus of undershooting is used in order to set up power lower than the power (temporary target power Petmp1) which an engine 22 should output essentially from demand torque Tr* to ring wheel shaft 32a as a driving shaft, charge-and-discharge amount-required Pb* of a dc-battery 50, etc. as target power Pe*. that is While setting up target power Pe* of an engine 22 as a value only with the amount Peus of undershooting lower than the temporary target power Petmp1 and controlling an engine 22 by target power Pe* If target torque Tm1* of motors MG1 and MG2 and Tm2* are set up and motors MG1 and MG2 are controlled so that demand torque Tr* acts on ring wheel shaft 32a Since power with which only the part of the amount Peus of undershooting is stored in a dc-battery 50 can be lessened It is a motor MG 2 (by the case), making demand torque Tr* (damping force) act on ring wheel shaft 32a, when an accelerator pedal 83 is returned. the ** motor MG 1 -- containing -- it is avoidable that a dc-battery 50 is overcharged by the regeneration energy revived.
[0080]
In this way, if target power Pe* of an engine 22 is set up The torque and the engine speed in the point whose engine 22 can operate target power Pe* efficiently among the operation points in which an output is possible are set up as target torque Te* of an engine 22, and target engine-speed Ne* (step S212). While setting up target several Nm rotation 1* of a motor MG 1 by the above-mentioned formula (8) based on target rotational frequency Ne*, the rotational frequency Nr (Nm2/Gr) of ring wheel shaft 32a, and gear ratio rho of the power distribution integrated device 30 which were set up Target torque Tm1* of a motor MG 1 is set up by the above-mentioned formula (3) using 1 set-up target several Nm rotation 1* and several Nm current rotation (step S214). Target torque Tm2* of a motor MG 2 is set up by the above-mentioned formula (9) using demand torque Tr*, target torque Tm1* of the set-up motor MG 1, gear ratio rho of the power distribution integrated device 30, and the gear ratio Gr of a reduction gear 35 (step S216). And processing which outputs to an engine ECU 24 about target engine-speed Ne* of an engine 22, and is respectively outputted to a motor ECU 40 about target torque Tm1* of a motor MG 1 and target torque Tm2* of a motor MG 2 is performed (step S218), and this routine is ended.
[0081]
According to the hybrid car of the 2nd example explained above Power lower than the power (temporary target power Petmp1) which an engine 22 should output essentially from demand torque Tr* to ring wheel shaft 32a, charge-and-discharge amount-required Pb* of a dc-battery 50, etc. is made into target power Pe*. Since target torque Tm1* of motors MG1 and MG2 and Tm2* are set up and motors MG1 and MG2 are controlled so that demand torque Tr* acts on ring wheel shaft 32a while setting up and controlling an engine 22 It is avoidable that a dc-battery 50 is overcharged by the regeneration energy revived by the motor MG 2 (a motor MG 1 is included depending on the case), making demand torque Tr* corresponding to step on return of an accelerator pedal 83 act on ring wheel shaft 32a. Consequently, aggravation of drivability can be controlled, taking into consideration the charge limit Win of a dc-battery 50.
[0082]

Although considered as the thing which processed by annealing to the temporary target power Petmp1 and this and which anneals and sets up deflection with the target power Petmp2 as an amount Peus of undershooting in the hybrid car of the 2nd example, it is good also as what sets up the predetermined amount which was not restricted to this, for example, was defined beforehand as an amount Peus of undershooting.

[Example 3]

[0083]

Next, the hybrid car of the 3rd example is explained. The hybrid car of the 3rd example is also equipped with the same configuration as the hybrid car 20 of an example except for the point that the processings performed with the electronic control unit 70 for hybrids differ. Therefore, the sign same about the same configuration of the hybrid car 20 of an example is attached among the hybrid cars of the 3rd example, and since the detailed explanation overlaps, it is omitted. Drawing 6 is a flow chart which shows an example of the 3rd operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car of the 3rd example. This routine is repeatedly performed for every (every [for example,] 8msec) predetermined time from from, when an operator does OFF actuation of the accelerator pedal 83.

[0084]

When the 3rd operation control routine is performed, CPU72 of the electronic control unit 70 for hybrids first, like processing of steps S100 and S102 of the 1st operation control routine of drawing 2 1, Nm2, etc. are inputted the accelerator opening Acc, the vehicle speed V, the rotational frequency Ne of an engine 22, and several Nm rotation of motors MG1 and MG2 (step S300). While setting up demand torque Tr* of ring wheel shaft 32a as a driving shaft using the map illustrated to above-mentioned drawing 3 with the inputted accelerator opening Acc and the vehicle speed V What added charge-and-discharge amount-required Pb* of a dc-battery 50 and a loss to what multiplied set-up demand torque Tr* by the engine speed Nr (Nm2/Gr) of ring wheel shaft 32a is set up as target power Pe* of an engine 22 (step S302).

[0085]

Then, the torque and the engine speed in the point whose engine 22 can operate target power Pe* efficiently among the operation points in which an output is possible are set up as target torque Te* of an engine 22, and target engine-speed Ne* (step S304). While setting up target several Nm rotation 1* of a motor MG 1 by the above-mentioned formula (8) based on target rotational frequency Ne*, the rotational frequency Nr (Nm2/Gr) of ring wheel shaft 32a, and gear ratio rho of the power distribution integrated device 30 which were set up Target torque Tm1* of a motor MG 1 is set up by the above-mentioned formula (3) using 1 set-up target several Nm rotation 1* and several Nm current rotation (step S306). Target torque Tm2* of a motor MG 2 is set up by the above-mentioned formula (9) using demand torque Tr*, target torque Tm1* of the set-up motor MG 1, gear ratio rho of the power distribution integrated device 30, and the gear ratio Gr of a reduction gear 35 (step S308).

[0086]

Next, motor torque limitation Tm2lim as torque which may divide into the charge limit Win of a dc-battery 50 by 2 what reduced a product (power) and a loss with 1 and target torque Tm1* several Nm current rotation of a motor MG 1 several Nm current rotation of a motor MG 2, and may be outputted to it from a motor MG 2 is calculated (step S310). And [whether target torque Tm2* of a motor MG 2 is more than motor torque limitation Tm2lim, and] Namely, since both target torque Tm2* and motor torque limitation Tm2lim are negative values, the absolute value of target torque Tm2* judges whether it is below the absolute value of motor torque limitation Tm2lim (step S312). If judged with target torque Tm2* not being more than motor torque limitation Tm2lim The power revived by the motor MG 2 exceeding motor torque limitation Tm2lim in order to carry out motoring of the engine 22 and to consume it by the motor MG 1 Processing which corrects target torque Tm1* of the motor MG 1 set up at step S306 by the degree type (11) is performed (step S314). This processing is performed by correcting target torque Tm1* so that the power equivalent to the part to which target torque Tm2* exceeded motor torque limitation Tm2lim as shown in a formula (11) may be consumed by the motor MG 1.

[0087]
Tm1*<-Tm1*+ (Tm2lim-Tm2*) and Nm2/Nm1 (11)
[0088]
And when target rotational frequency Ne* is set up, target rotational frequency Ne* of an engine 22 is corrected by counting backward the relational expression showing in the degree type (12) which asks for target torque Tm1* which should be outputted from the motor MG 1 in the feedback control of the motor MG 1 for rotating an engine 22 by target rotational frequency Ne* based on the deflection of target rotational frequency Ne* and the current rotational frequency Ne (step S316). Target engine-speed Ne* at this time means the engine speed of the engine 22 when motoring of the engine 22 is carried out by the torque outputted from a motor MG 1.
[0089]
Tm1*= last time Tm1*+PID (Ne, Ne*) (12)
[0090]
Correction of target rotational frequency Ne* judges whether an engine 22 has a rotational frequency higher than the engine-speed limit Nelim as an upper limit of a pivotable rotational frequency when motoring of the engine 22 is carried out by the output of the torque from this corrected target rotational frequency Ne* MG1, i.e., a motor, (step S318). If it judges that corrected target engine-speed Ne* is higher than the engine-speed limit Nelim It is judged that the engine speed of an engine 22 will exceed the engine-speed limit Nelim if motoring of the engine 22 is carried out by the motor MG 1 so that it may fit in the range of the charge limit Win of a dc-battery 50. First, target torque Tm1* of the motor MG 1 at the time of carrying out feedback control of the motor MG 1 so that an engine 22 may serve as an engine speed equivalent to the engine-speed limit Nelim is corrected by the degree type (13) (step S320).
[0091]
Tm1* <- last Tm1*+PID (Ne, Nelim) (13)
[0092]
And the power which reduced the product (power) and loss of 2 the product (power) of 1, target torque Tm2* of a motor MG 2, and several Nm current rotation target torque Tm1* of a motor MG 1 and several Nm current rotation, i.e., the dump power exceeding the charge limit Win of a dc-battery 50 of a part, is set as the charge limit Win of a dc-battery 50 as power consumption Pair of an air-conditioner 90 (step S322).
[0093]
in this way, it is judged with target torque Tm2* being more than motor torque limitation Tm2lim at the step S312 after setting up the power consumption Pair of an air-conditioner 90, or When target engine-speed Ne* is judged at step S318 to be below the engine-speed limit Nelim About target torque Te* and target engine-speed Ne*, in an engine ECU 24 When [at which processing outputted to a motor ECU 40 about target torque Tm1* and target torque Tm2* is performed] Pair is set up for the power consumption of an air-conditioner 90 at the step S322 both being alike -- irrespective of the existence of actuation of an airconditioning switch 92, processing which operates an air-conditioner 90 by power consumption Pair is performed (step S324), and this routine is ended. Thus, the damping force required by accelerator-off can be made to act on ring wheel shaft 32a as a driving shaft more certainly by operating an air-conditioner 90 compulsorily and making it consume irrespective of the existence of actuation according the dump power exceeding the charge limit Win of the dc-battery 50 which cannot be consumed by the motor MG 1, either of a part to an airconditioning switch 92, avoiding overcharge of a dc-battery 50.
[0094]
Since demand torque Tr* required by accelerator-off is outputted to a driving shaft, if an engine 22 and motors MG1 and MG2 are controlled, when the power exceeding the charge limit Win of a dc-battery 50 will be charged according to the hybrid car of the 3rd example explained above Since the excessive power exceeding the charge limit Win is made to consume compulsorily by the air-conditioner 90, demand torque Tr* can be more certainly outputted to ring wheel shaft 32a, avoiding overcharge of a dc-battery 50. Consequently, aggravation of drivability can be controlled, taking into consideration the charge limit Win of a dc-battery 50.

[0095]
In the hybrid car of the 3rd example, shall carry out motoring of the engine 22 by the motor MG 1, and the dump power exceeding the charge limit Win of a dc-battery 50 of a part shall be consumed. Although an air-conditioner 90 is operated compulsorily and dump power is made to consume when this dump power cannot be consumed by the motor MG 1, only actuation of an air-conditioner 90 is available also as a thing which makes dump power consume, without carrying out motoring of the engine 22 by the motor MG 1.
[0096]
Although the dump power which exceeds the charge limit Win of a dc-battery 50 by operating an air-conditioner 90 compulsorily is made to consume by the air-conditioner 90 in the hybrid car of the 3rd example, it is good also as a thing which makes dump power consume with other auxiliary machinery other than air-conditioner 90 in the range which does not have trouble in transit of a hybrid car.
[Example 4]
[0097]
Next, the hybrid car of the 4th example is explained. The hybrid car of the 4th example is also carrying out the same configuration as the hybrid car 20 of an example except for the point that processings by the electronic control unit 70 for hybrids differ. Therefore, the sign same about the same configuration of the hybrid car 20 of an example is attached among the hybrid cars of the 4th example, and since the detailed explanation overlaps, it is omitted. Drawing 7 is a flow chart which shows an example of the 4th operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car of the 4th example. This routine is repeatedly performed for every (every [for example,] 8msec) predetermined time, when an accelerator pedal 83 is turned off from ON or the slip by slip is generated in driving wheels 63a and 63b. Whether the accelerator pedal 83 was turned off from ON It can judge by the last accelerator opening Acc of the accelerator pedal position sensor 84, and this accelerator opening Acc. Whether the slip by slip was generated in driving wheels 63a and 63b It can judge based on time amount change (angle-of-rotation acceleration) of the angular rate of rotation calculated based on the angle of rotation from the rotation location detection sensor 44 attached in the motor MG 2 mechanically connected with driving wheels 63a and 63b.
[0098]
When the 4th operation control routine is performed, CPU72 of the electronic control unit 70 for hybrids First, 1 and Nm2 are inputted the accelerator opening Acc, the vehicle speed V, a rotational frequency Ne, and several Nm rotation (step S400). While setting up demand torque Tr* which should be outputted to ring wheel shaft 32a on the map for demand set torques of above-mentioned drawing 3 based on the accelerator opening Acc and the vehicle speed V which were inputted Target power Pe* which should be outputted from an engine 22 by the sum of the thing and charge-and-discharge amount-required Pb* of a dc-battery 50 which multiplied demand torque Tr* by the engine speed Nr (= Nm2/Gr) of ring wheel shaft 32a, and a loss is set up (step S402). The engine speed and torque in the most efficient point are set up as target engine-speed Ne* of an engine 22, and target torque Te* among the operation points of the engine 22 in which an output of target power Pe* is possible (step S404).
[0099]
It continues. While setting up target several Nm rotation 1* of a motor MG 1 by the above-mentioned formula (8) based on target rotational frequency Ne*, the rotational frequency Nr of ring wheel shaft 32a, and gear ratio rho of the power distribution integrated device 30 which were set up Target torque Tm1* of a motor MG 1 is set up by the above-mentioned formula (3) using 1 set-up target several Nm rotation 1* and several Nm current rotation (step S406). Target torque Tm2* of a motor MG 2 is set up by the above-mentioned formula (9) using demand torque Tr*, target torque Tm1* of the set-up motor MG 1, gear ratio rho of the power distribution integrated device 30, and the gear ratio Gr of a reduction gear 35 (step S408). If target torque Tm1* of motors MG1 and MG2 and Tm2* are set up, the motor power Pm1 and Pm2 as power generated or consumed by a degree type (14) and (15) by motors MG1 and MG2, respectively will be calculated by being based on 1 and Nm2 the several Nm rotation inputted as

target torque Tm1* and Tm2* (step S410).
[0100]
[Equation 1]

$$Pm1 = Tm1^* \times Nm1 \quad \cdots(14)$$

$$Pm2 = Tm2^* \times Nm2 \quad \cdots(15)$$

[0101]
Count of the motor power Pm1 and Pm2 judges whether the sum of the calculated motor power Pm1 and Pm2 is under the charge limit Win of a dc-battery 50 (step S412). (is the absolute value of the sum of the motor power Pm1 and Pm2 larger than the absolute value of the charge limit Win or not?) If judged with the sum of the motor power Pm1 and Pm2 not being under the charge limit Win, dump power judges that it does not generate, it will transmit target torque Tm1* and Tm2* to a motor ECU 40 while it transmits target torque Te* and target engine-speed Ne* to an engine ECU 24 (step S416), and will end this routine. On the other hand, if the sum of the motor power Pm1 and Pm2 is judged to be under the charge limit Win Dump power Psur is calculated by subtracting the sum of the motor power Pm1 and Pm2 from the charge limit Win (step S414). While transmitting target torque Te* and target engine-speed Ne* to an engine ECU 24, target torque Tm1*, Tm2*, and dump power Psur are transmitted to a motor ECU 40 (step S416), and this routine is ended.
[0102]
Next, processing of a motor ECU 40 in which target torque Tm1*, Tm2*, and dump power Psur were received is explained. Drawing 8 is a flow chart which shows an example of the motor control routine performed by the motor ECU 40. If this motor control routine is performed, a motor ECU 40 will first input data, such as the rotation location thetam1 from the phase currents Iu1, Iv1, Iu2, and Iv2 of the motors MG1 and MG2 from the current sensor which is not illustrated, or the rotation location detection sensors 43 and 44, thetam2, and dump power Psur, (step S450). Then, the electrical angles theta1 and theta2 are calculated by **(ing) the inputted rotation location thetam1 and thetam2 by P1 and P2 pole pairs of motors MG1 and MG2 (step S452). Total of the phase current which flows U phase of the three phase coil of motors MG1 and MG2, V phase, and W phase is made into a value 0. A degree type (16), Coordinate transformation (three-phase-circuit -2 phase-number conversion) of the phase currents Iu1, Iv1, Iu2, and Iv2 is carried out to the currents Id1, Iq1, Id2, and Iq2 of d shaft and q shaft by (17) (step S454). Current command Id1* of d shaft and q shaft, Iq1*, Id2*, and Iq2* are set up from target torque Tm1* set up at steps S406 and S408 of the 4th operation control routine of drawing 7 , and Tm2* (step S456).
[0103]
[Equation 2]

$$\begin{bmatrix} Id1 \\ Iq1 \end{bmatrix} = \sqrt{2} \begin{bmatrix} -sin(\theta 1 - 120) & sin(\theta 1) \\ -cos(\theta 1 - 120) & cos(\theta 1) \end{bmatrix} \begin{bmatrix} Iu1 \\ Iv1 \end{bmatrix} \quad \cdots(16)$$

$$\begin{bmatrix} Id2 \\ Iq2 \end{bmatrix} = \sqrt{2} \begin{bmatrix} -sin(\theta 2 - 120) & sin(\theta 2) \\ -cos(\theta 2 - 120) & cos(\theta 2) \end{bmatrix} \begin{bmatrix} Iu2 \\ Iv2 \end{bmatrix} \quad \cdots(17)$$

[0104]
Next, it judges whether the sum of the motor power Pm1 and Pm2 was judged at step S412 of the 4th operation control routine of whether there is any dump power Psur and drawing 7 to be

under the charge limit Win (step S458). If judged with there being no dump power Psur, the electrical-potential-difference commands Vd1, Vq1, Vd2, and Vq2 of d shaft in motors MG1 and MG2 and q shaft will usually be calculated by the processing at the time, i.e., degree type (18) - (21) (step S462). Here, among formula (18) - (21), "KPd1", "KPq1", "KPd2", and "KPq2" are proportionality coefficients, and "KId1", "KIq1", "KId2", and "KIq2" are integral multipliers.
[0105]
[Equation 3]

$$Vd1 = KPd1(Id1^* - Id1) + \sum KId1(Id1^* - Id1) \quad \cdots(18)$$

$$Vq1 = KPq1(Iq1^* - Iq1) + \sum KIq1(Iq1^* - Iq1) \quad \cdots(19)$$

$$Vd2 = KPd2(Id2^* - Id2) + \sum KId2(Id2^* - Id2) \quad \cdots(20)$$

$$Vq2 = KPq2(Iq2^* - Iq2) + \sum KIq2(Iq2^* - Iq2) \quad \cdots(21)$$

[0106]
And a degree type (22), While carrying out coordinate transformation (three-phase-circuit -2 phase-number conversion) to the electrical-potential-difference commands Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 which should impress the electrical-potential-difference commands Vd1, Vq1, Vd2, and Vq2 of d shaft and q shaft to U phase of the three phase coil of motors MG1 and MG2, V phase, and W phase by (23) (step S464) The electrical-potential-difference commands Vu1, Vv1, Vw1, Vu2, Vv2, and Vw2 are changed into the PWM signal for carrying out switching control of the inverters 41 and 42 (step S466). By outputting the changed PWM signal to inverters 41 and 42, processing which carries out drive control of the motors MG1 and MG2 is performed (step S468), and this routine is ended.
[0107]
[Equation 4]

$$\begin{bmatrix} Vu1 \\ Vv1 \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} \cos(\theta 1) & -\sin(\theta 1) \\ -\cos(\theta 1 - 120) & -\sin(\theta 1 - 120) \end{bmatrix} \begin{bmatrix} Vd1 \\ Vq1 \end{bmatrix}$$
$$Vw1 = -Vu1 - Vv1 \quad \cdots(22)$$

$$\begin{bmatrix} Vu2 \\ Vv2 \end{bmatrix} = \sqrt{\frac{2}{3}} \begin{bmatrix} \cos(\theta 2) & -\sin(\theta 2) \\ -\cos(\theta 2 - 120) & -\sin(\theta 2 - 120) \end{bmatrix} \begin{bmatrix} Vd2 \\ Vq2 \end{bmatrix}$$
$$Vw2 = -Vu2 - Vv2 \quad \cdots(23)$$

[0108]
It is judged that there is a possibility of a dc-battery 50 overcharging or charging with an excessive electrical potential difference if judged with there being dump power Psur at step S458. Current command Id2* of the motor MG 2 for which it asked at step S456 by the degree type (24) so that it might be consumed by the motor MG 2 by impressing the reactive power which dump power Psur does not contribute to torque to a motor MG 2 is corrected (step S460). Drive control of the motors MG1 and MG2 of steps S462-S468 is performed. Here, "K" is a conversion factor to the electrical potential difference of a motor MG 2 among a formula (24). Thus, overcharge of a dc-battery 50 and charge by the excessive electrical potential difference

are prevented, maintaining target torque Tm2* by making the power for [unacceptable in a dc-battery 50] a surplus consume by the motor MG 2 by supply of the reactive power which does not contribute to generating of torque. In addition, although only current command Id2* of d shaft shall be corrected in the example, it is good also as what also corrects current command Iq2* collectively so that target torque Tm2* may be maintained in consideration of the effect on the field by the permanent magnet by correction of this current command Id2*.
[0109]
[Equation 5]

$$Id2^{*} \leftarrow Id2^{*} + \frac{Psur}{K \cdot Nm2} \qquad \cdots(24)$$

[0110]
According to the hybrid car of the 4th example explained above, when the unacceptable dump power Psur occurs to a dc-battery 50, it can consume by the motor MG 2, maintaining target torque Tm2* by supplying the reactive power which does not contribute to generating of torque to a motor MG 2. Consequently, overcharge of a dc-battery 50 and charge by excessive power can be prevented, coping with demand torque Tr*. And since dump power Psur is made to consume by the motor MG 2, it is not necessary to prepare the new device for consuming dump power Psur.
[0111]
Although dump power Psur is made to consume by the motor MG 2 in the hybrid car of the 4th example, maintaining target torque Tm2*, it is good also as a thing made to consume by the motor MG 1, maintaining target torque Tm1*, and it is good also as a thing made to consume by both motors MG1 and MG2, maintaining target torque Tm1* and Tm2*.
[0112]
Although it shall change gears by the reduction gear 35 and the power of a motor MG 2 shall be outputted to ring wheel shaft 32a in the hybrid car 20 of an example, the hybrid car of the 2nd example, the hybrid car of the 3rd example, or the hybrid car of the 4th example So that it may illustrate to the hybrid car 120 of the modification of drawing 9 It is good also as what connects the power of a motor MG 2 to the axle (axle connected to the wheels 64a and 64b in drawing 9) with which ring wheel shaft 32a differs from the connected axle (axle to which driving wheels 63a and 63b were connected).
[0113]
In the hybrid car 20 of an example, the hybrid car of the 2nd example, the hybrid car of the 3rd example, or the hybrid car of the 4th example Although the power of an engine 22 shall be outputted to ring wheel shaft 32a as a driving shaft connected to driving wheels 63a and 63b through the power distribution integrated device 30 It has the outer rotor 234 connected to the driving shaft which outputs power to the inner rotor 232 connected to the crankshaft 26 of an engine 22, and driving wheels 63a and 63b so that it may illustrate to the hybrid car 220 of the modification of drawing 10 . While transmitting a part of power of an engine 22 to a driving shaft, it is good also as a thing equipped with the motor 230 for Rota which changes residual power into power.
[0114]
As mentioned above, although the gestalt of operation of this invention was explained using the example, as for this invention, it is needless to say that it can carry out with the gestalt which becomes various within limits which are not limited to such an example at all and do not deviate from the summary of this invention.
[Brief Description of the Drawings]
[0115]
[Drawing 1] It is the block diagram showing the outline of the configuration of the hybrid car 20 which is one example of this invention.

[Drawing 2] It is the flow chart which shows an example of the 1st operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car 20 of an example.
[Drawing 3] It is the map in which the relation between the accelerator opening Acc, and the vehicle speed V and demand torque Tr* is shown.
[Drawing 4] It is a collinear Fig. for explaining dynamically the rotation element of the power distribution integrated device 30.
[Drawing 5] It is the flow chart which shows an example of the 2nd operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car of the 2nd example.
[Drawing 6] It is the flow chart which shows an example of the 3rd operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car of the 3rd example.
[Drawing 7] It is the flow chart which shows an example of the 4th operation control routine performed with the electronic control unit 70 for hybrids of the hybrid car of the 4th example.
[Drawing 8] It is the flow chart which shows an example of the motor control routine performed by the motor ECU 40.
[Drawing 9] It is the block diagram showing the outline of the configuration of the hybrid car 120 of a modification.
[Drawing 10] It is the block diagram showing the outline of the configuration of the hybrid car 220 of a modification.
[Description of Notations]
[0116]
20,120,220 A hybrid car, 22 Engine, 24 The electronic control unit for engines (engine ECU), 26 Crankshaft, 28 A damper, 30 A power distribution integrated device, 31 A sun gear, 32 Ring wheel, 32a A ring wheel shaft, 33 A pinion gear, 34 Carrier, 35 A reduction gear, 40 The electronic control unit for motors (motor ECU), 41 42 43 An inverter, 44 A rotation location detection sensor, 50 Dc-battery, 51 A temperature sensor, 52 The electronic control unit for dc-batteries (dc-battery ECU), 54 Power Rhine, 60 A gear device, 62 Differential gear, 63a, 63b, 64a, 64b A driving wheel, 70 The electronic control unit for hybrids, 72 CPU, 74 ROM, 76 RAM, 80 Ignition switch, 81 A shift lever, 82 A shift position sensor, 83 Accelerator pedal, 84 An accelerator pedal position sensor, 85 Brake pedal, 86 A brake-pedal position sensor, 88 A speed sensor, 90 Air conditioner (air-conditioner), 92 An airconditioning switch, 94 A converter, 230 A pair Rota motor, 232 An inner rotor, 234 An outer rotor, MG1, MG2 Motor.

[Translation done.]

DESCRIPTION OF DRAWINGS

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[Translation done.]